

Systematic Virology

Collections



By

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تجميعات الفيروسات
+ أمراض

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RNA virus Families

① Single stranded RNA:

+ve Sense

1. Picornaviridae:

- Non-enveloped (naked)
- Non-segmented
- VPg at 5' end
- polyadenylated (poly A tail) at 3' end

2. Caliciviridae:

- Non-enveloped (naked)
- Non-segmented
- VPg at 5' end
- polyadenylated (poly A tail) at 3' end
- 32 Cup-shaped surface depressions
- subgenomic RNA

3. Togaviridae:

- enveloped (Envelope loosely attached to capsid)
- Non-segmented
- Capped at 5' end
- polyadenylated (poly A tail) at 3' end
- subgenomic RNA
- arboviruses (seasonal disease)

4- Flaviviridae:

- enveloped
- Non-Segmented
- Capped at 5' end
- No poly(A) tail at 3' end
- arboviruses (Seasonal disease)
- Immunosuppression (Bovine virus diarrhea, related to G.pestivirus)

5- Coronaviridae:

- enveloped → with pear-shaped (club-shaped) peplomers (spikes) giving the virus Crown-Like or Solar appearance.
- Non-Segmented
- Capped at 5' end
- poly(A) tail at 3' end
- Subgenomic mRNA
- Nested mRNA
- genetic reassortment.
- Curling and dwarfing in ECE (IBV).

-ve SENSE

1- paramyxoviridae:

- enveloped
- Non-Segmented
- Contain F-protein (Fusion protein)
- have affinity to mucus

2. Orthomyxoviridae:

- enveloped
- Segmented (6-8 segments)
- have affinity to mucus
- genetic reassortment
- Base pairing of segment
- antigenic drift and shift
- Cap Snatching (nucleus)

3. Bunyaviridae:

- enveloped
- Segmented (3 segments)
- ambisense
- genetic reassortment
- Base pairing
- Cap Snatching (Cytoplasm)
- arboviruses
- subgenomic mRNA

4. Rhabdoviridae:

- enveloped
- Non-segmented
- subgenomic mRNA
- have terminal triphosphate at 5' end
- Bullet shape
- arboviruses
- Negri bodies (Rabies virus)

② double stranded RNA:

1. Birnaviridae:

- Non-enveloped
- Segmented (2 segments)
- VPg at 5' end of each segment
- have direct terminal repeats and Inverted terminal repeats at both ends.
- Base pairing
- Immunosuppression Virus (Infectious bursal disease)

2. Reoviridae:

- Non-enveloped.
- Segmented (10-12 segments)
- Capped at 5' end of +ve sense strand and phosphorylated at 5' end of -ve sense strand.
- 2-3 Capsid Layers
- Incomplete uncoating virus
- Ring-shape Capsomers (orbivirus)
- genetic reassortment
- arboviruses.

DNA virus Families

1. poxviridae:

- Lateral bodies
- Terminal Loop (TL)
 - Inverted Terminal repeat (ITR)
 - unique sequence (US)
 - Tandem repeats (TR)
 - cross-linked protein
- Cytoplasmic replication and form ICI B.
- genetic reassortment
- pock Lesion.

2. Herpesviridae:

- tegument
- DNA wrapped around spool-like protein
- unique sequence
- genomic isomers
- Latent infection
- Immunosuppression
- Thymidine Kinase
- Intranuclear inclusion bodies
- pock Lesions
- In-ovo vaccination (Marek's disease virus)

virus Families Contain segmented genome :

- 1- orthomyxoviridae → 6-8 segments
- 2- Bunyaviridae → 3 segments
- 3- Reoviridae → 10-12 segments
- 4- Birnaviridae → 2 segments

genetic reassortment (Recombination):

- 1- Coronaviridae (Non-segmented RNA)
 - 2- orthomyxoviridae
 - 3- Bunyaviridae
 - 4- Reoviridae
 - 5- poxviridae (DNA)
- ← segmented RNA

Subgenomic mRNA :

- 1- Caliciviridae
- 2- Togaviridae
- 3- Coronaviridae (nested set of subgenomic mRNAs)
- 4- Bunyaviridae
- 5- Rhabdoviridae

Cap snatching occur in some virus Families replication :

<u>In nucleus</u>	<u>In cytoplasm</u>
orthomyxoviridae	Bunyaviridae

● Virus Families transmitted through arthropods (insects) (arboviruses):

- 1- Togaviridae
- 2- Flaviviridae
- 3- Rhabdoviridae
- 4- Bunyaviridae
- 5- Reoviridae
- 6- Arenaviridae
- 7- Poxviridae

● Seasonal viral diseases (transmitted through arthropods):

- 1- Rift Valley Fever virus
- 2- Blue tongue virus
- 3- African horse sickness
- 4- Bovine ephemeral fever
- 5- Sheep pox
- 6- Lumpy skin disease

● Virus families has VPg at 5' end of its genome:

- 1- Picornaviridae
- 2- Caliciviridae
- 3- Birnaviridae

• Virus Families capped at 5' end of its genome:

- 1- Togaviridae
- 2- Flaviviridae
- 3- Coronaviridae
- 4- Reoviridae (Capped at 5' end of +ve sense strand)

• Virus Families polyadenylated (has poly A tail) at 3' end of its genome:

- 1- Picornaviridae
- 2- Caliciviridae
- 3- Togaviridae
- 4- Coronaviridae

• Virus Family has terminal triphosphate at 5' end of its genome:

Rhabdoviridae

• Virus Families has base pairing of its genome:

- 1- Orthomyxoviridae
- 2- Bunyaviridae
- 3- Birnaviridae

● Virus families have affinity to mucus :

- 1- paramyxoviridae (non-segmented genome)
- 2- orthomyxoviridae (segmented genome)

● Virus family show genomic isomers

Herpesviridae

● Virus families have unique sequence in its genome :

- 1- Herpesviridae
- 2- poxviridae

● Virus family has Terminal Loop or Tandem repeats or cross linked protein in its genome :

poxviridae

● RNA virus family has direct terminal repeats and inverted terminal repeats at both ends :

Birnaviridae

● Virus family has 32 cup-shaped surface depressions:
Caliciviridae

● Virus family has an envelop loosely attached to nucleocapsid resembling Roman mantle or cloak:
Togaviridae

● Virus family has club-shaped peplomers "Crown-Like" in appearance:
Coronaviridae

● Fusion (F) protein is a part of a virus family envelop:
Paramyxoviridae

● Virus family has a bullet shape:
Rhabdoviridae

● Virus family has 2-3 capsid layers:
Reoviridae

• Lateral bodies is a part of dsDNA virus family:
poxviridae

• Virus family has a tegument protein in its structure:
Herpesviridae

• Virus family undergo incomplete uncoating:
Reoviridae

• Virus family produce negri bodies
Rhabdoviridae (Rabies virus, related to G. Lyssa virus)

• Virus family undergo antigenic drift and shift:
1- Orthomyxoviridae (G. Influenza virus)
2- Bunyaviridae

• Virus genus its capsid contain ring-shaped capsomers:
G. Orbivirus related to F. Reoviridae

• Naked virus family its genome is segmented dsRNA and has one capsid layer

Birnaviridae

• virus families under order Mononegavirales:

1. Paramyxoviridae
2. Rhabdoviridae
3. Bornaviridae
4. Filoviridae

➔ Mononegavirales means non-segmented -ve sense ssRNA.

• virus families under order Nidovirales:

1. Family: Coronaviridae
 - Subfamily: Coronavirinae
 - Subfamily: Torovirinae

2. Family: arteriviridae

3. Family: Roniviridae

➔ Nido from nidus meaning nest → due to transcription of nested set of mRNAs.

	piCorna	CaLiCi	Toga	FLavi	Cořona	paramyxo	orthomyxo	Bunya	Rhabdo	Reo	
strand	SS								→	Ds	Ds
Segmentation	Non-segmented					→	segmented (6-8)	Segmented (3)	Non-segmented	Segmented (10-12)	Segmented (2)
polarity	+ve Sense			→		-ve Sense	-ve Sense	-ve or ambisense	-ve sense	double stranded	
5' end	VPg	VPg	Caped	→		-	-	-	-	Cap at 5' end of +ve strand and p at 5' end of -ve strand	VPg
3' end	poly A		→	-	poly A	-	-	-	-	-	-
Subgenomic RNA	-	+	+	-	+	-	-	+	+	-	-
genetic reassortment	-	-	-	-	+	-	+	+	-	+	-
Base pairing	-	-	-	-	-	-	+	+	-	-	+

Virus	Serotype	antigenicity
1-FMDV	7 (A, O, C, SAT ₁ , SAT ₂ , SAT ₃ and ASia)	No antigenic relationship
2-duck virus hepatitis	2-3 serotypes of DHV	all strains are immunologically similar
3-avian encephalomyelitis	one antigenic serotype	all strains are immunologically similar
4-Bovine virus diarrhea (BVDV)	2 different biotypes (cytopathic and non-cytopathic strains)	close antigenic relationship with 1-Swine Fever virus 2-Border disease virus
5-Infectious bronchitis virus	several serotypes (7-8) but grouped into 2 types: • Connecticut • Massachusetts.	There is cross reaction between serotypes
6-Newcastle disease (NDV)	one serotype antigenically.	all strains are antigenically similar
7-Rinderpest (Cattle plague)	one serotype (antigenically stable)	<ul style="list-style-type: none"> • Immunologically related to viruses that cause <ul style="list-style-type: none"> → Canine distemper → Measles → PPR. • Close serologically with PPR.
8-avian Influenza	Many subtypes	No cross reaction between subtypes

9- Rift Valley Fever (RVF)	only one Serotype	Serologically related to other phleboviruses
10- Rabies	one Serotype	antigenic relationship
11- bluetongue virus	25-26 different Serotypes	Less cross reaction between them
12- Infectious bursal disease (IBD)	2 Serotypes (ST ₁ and ST ₂)	No antigenic relationship
13- Sheep pox	one Serotype	cross reaction between members of genus Capripox (sheep pox virus, goat pox virus and LSDV)
14- Lumpy skin disease	one Serotype	as sheep pox
15- Fowl pox		Fowl pox is closely related to pigeon pox
16- Infectious Laryngotracheitis (ILT) (gallid herpes-virus - 1)	one Serotype	all strains are antigenically similar
17- Marek's disease (MD) (gallid herpes-virus - 2)	3 Serotypes • S ₁ (GHV ₂) • S ₂ (GHV ₃) • S ₃ (MHV ₁)	all strains are antigenically similar

● viruses have only one serotype:

- 1- avian encephalomyelitis virus
- 2- Newcastle disease
- 3- Rinderpest (cattle plague)
- 4- Rift Valley fever
- 5- Rabies
- 6- sheep pox
- 7- Lumpy skin disease.
- 8- Infectious Laryngotracheitis

● viruses have more than one serotype:

- 1- FMDV
- 2- duck virus hepatitis
- 3- Bovine virus diarrhoea
- 4- Infectious bronchitis virus
- 5- avian Influenza
- 6- Blue tongue
- 7- Infectious bursal disease
- 8- Marek's disease

● viruses Causing Immunosuppression:

- 1- Bovine virus diarrhoea (BVDV) →
infect cattle
- 2- Infectious bursal disease (IBDV) →
infect birds

• virus Cause Immunotolerant or persistent infected calf:

Bovine virus diarrhea (BVDV)

• virus has cytopathic and non-cytopathic strains:

Bovine virus diarrhea (BVDV)

• virus undergo antigenic drift and shift resulting in either epidemic or pandemic disease.

avian Influenza virus

• viruses produce intracytoplasmic inclusion bodies:

- 1- Newcastle disease virus
- 2- Cattle plague (Rinderpest)
- 3- Rabies virus (Negri bodies)
- 4- blue tongue virus
- 5- Sheep pox virus
- 6- Lumpy skin disease
- 7- Fowl pox virus

• viruses produce intranuclear inclusion bodies:

- 1- Newcastle disease virus
- 2- Cattle plague (Rinderpest) virus
- 3- Rift Valley Fever
- 4- Infectious Laryngotracheitis (gallid herpesvirus-1)
- 5- Marek's disease (gallid herpesvirus-2)

• viruses produce pock lesions on CAM

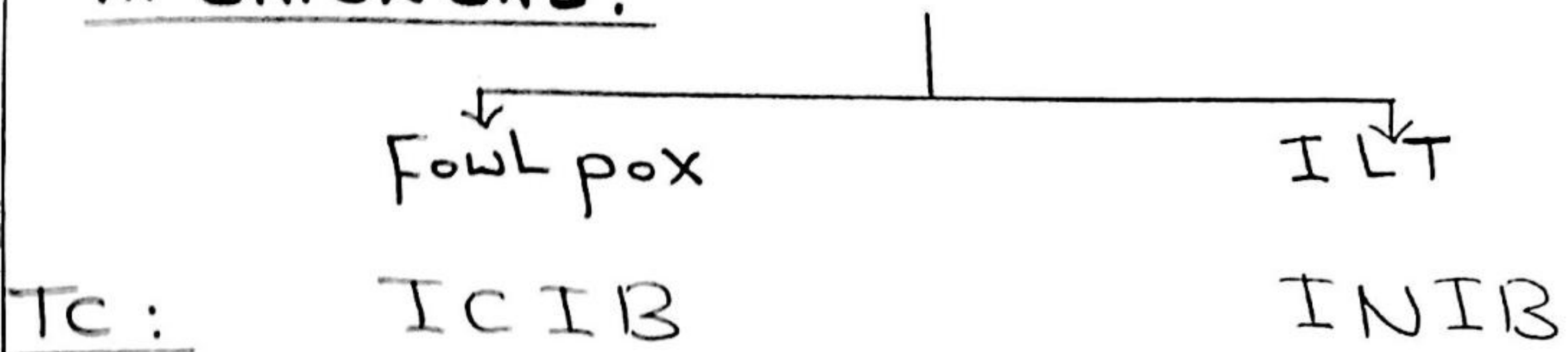
DNA viruses

- 1- sheep pox virus
- 2- Lumpy skin disease (LSD)
- 3- Fowl pox
- 4- Infectious Laryngotracheitis (ILT)
- 5- Marek's disease (MD)

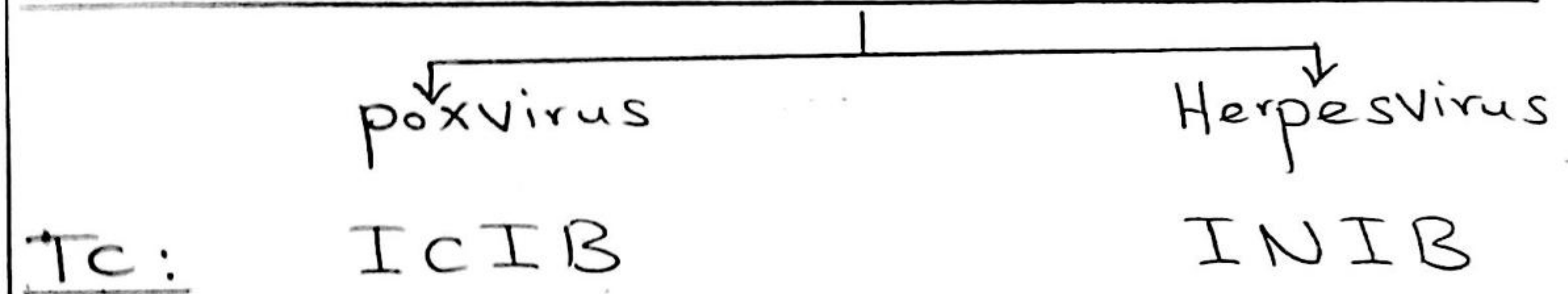
• virus infect birds causing curling and dwarfing of embryo in ECE

Infectious bronchitis virus (IBV)

● Viruses Causing diphtheretic membrane in chickens:



● Viruses isolated in ECE via CAM:

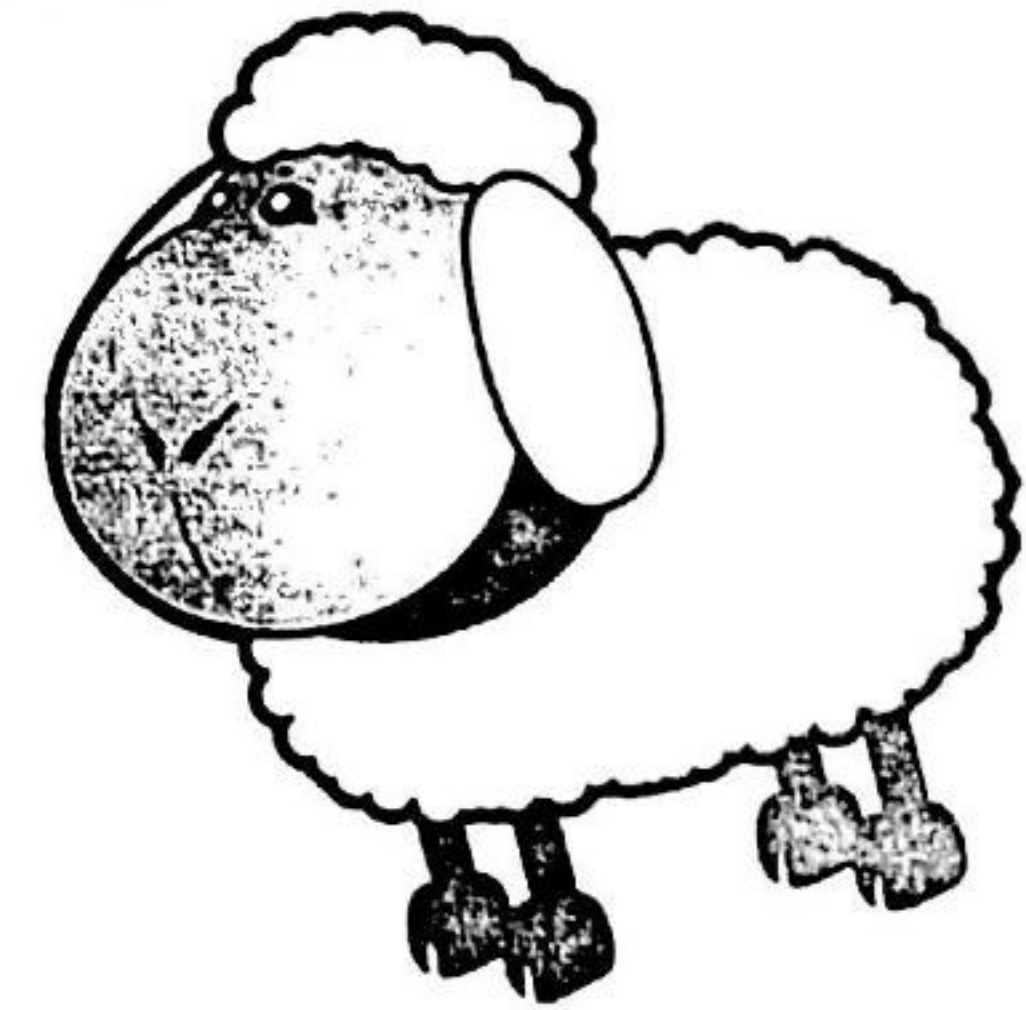
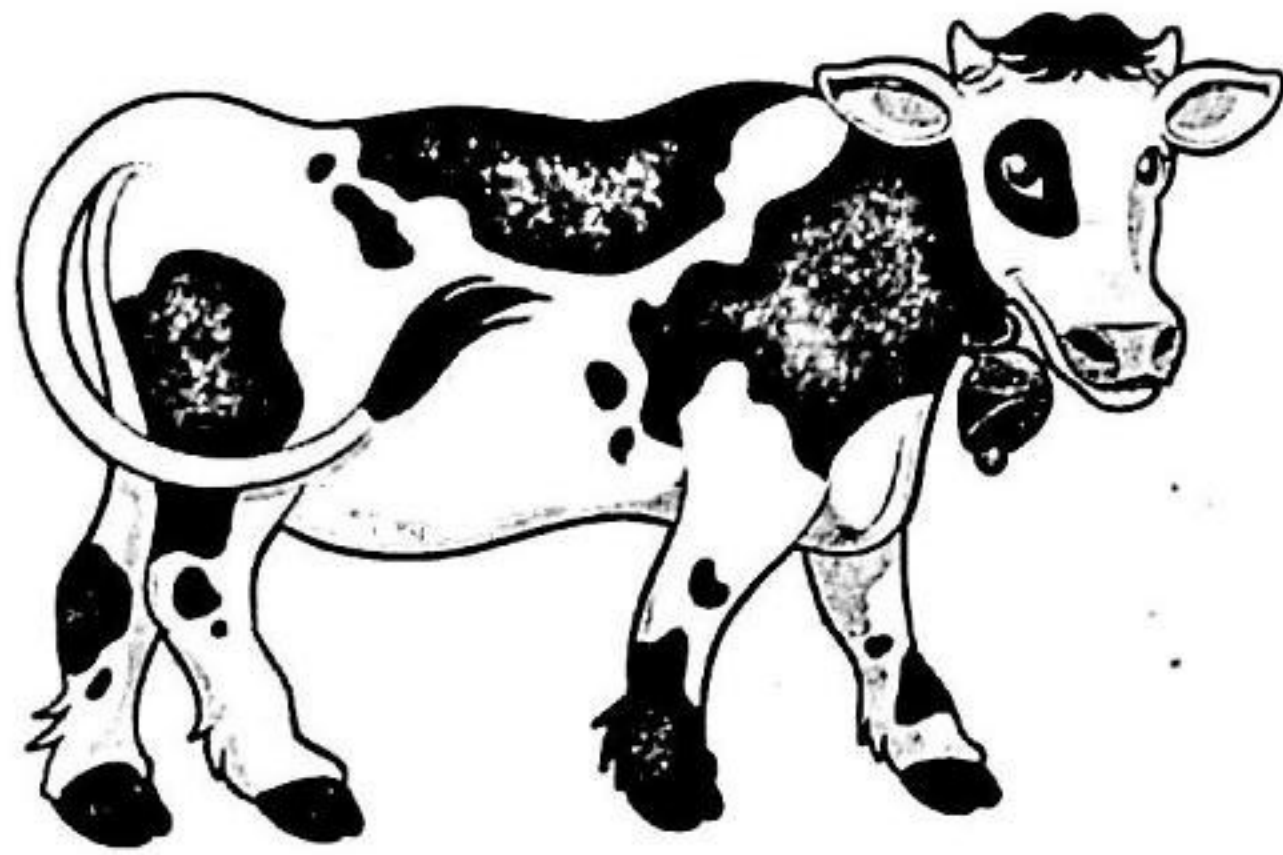


● Viruses Cause respiratory signs in poultry:

- ① Newcastle disease (ND)
- ② Avian influenza (AI)
- ③ Fowl pox
- ④ Infectious Laryngotracheitis (ILT)
- ⑤ Infectious bronchitis (IB)

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Summary Of Viral Diseases



Virus	Genus	SubFamily	Family	Order
① Foot and mouth disease (FMD)	Aphthovirus		Picornaviridae	Picornavirales
② duck virus hepatitis (DVH)	Avihepatovirus			
③ Avian encephalomyelitis (AE)	Tremovirus			
④ Rabbit Hemorrhagic disease (RHD)	Lagovirus		Caliciviridae	
⑤ Bovine virus diarrhea (BVD)	pestivirus		Flaviviridae	
⑥ avian infectious bronchitis (IB)	GammaCoronavirus	Coronavirinae	Coronaviridae	Nidovirales
⑦ Newcastle disease (ND) (avian paramyxovirus-1)	Avulavirus	Paramyxovirinae	Paramyxoviridae	Mononegavirales
⑧ Rinderpest virus (RPV)	Morbillivirus			
⑨ avian influenza (fowl plague)	Influenza A virus		Orthomyxoviridae	
⑩ Rift Valley Fever (RVF)	phlebovirus		Bunyaviridae	
⑪ Bovine Ephemeral Fever (BEF)	Ephemerovirus		Rhabdoviridae	Mononegavirales
⑫ Rabies Virus	Lyssavirus			
⑬ Blue tongue (BT)	orbivirus	Sedoreovirinae	Reoviridae	
⑭ Infectious Bursal disease (IBD) (gumboro disease)	Avibirnavirus		Birnaviridae	
⑮ Sheep pox	Capripoxvirus	Chordopoxvirinae	Poxviridae	Poxvirales
⑯ Lumpy skin disease (LSD)				
⑰ Infectious Laryngotracheitis (ILT) (Gallid herpesvirus-1)	ILTVirus	Alpha herpesvirinae	Herpesviridae	Herpesvirales
⑱ Marek's disease (MD) (Gallid herpesvirus-2)	Mardivirus			

	Serotype and antigenicity	Lab. diagnosis	Vaccines																																
<p>① Foot and mouth disease (FMD) (Aphthous Fever)</p> <p>مرض الحمى القلاعية الأبقار</p>	<p>• 7 Serotypes → A, O, C, SAT₁, SAT₂, SAT₃ and ASial (named acc. to its area of origin)</p> <p>• Each serotype contain subtypes:</p> <table border="0"> <tr> <td>A</td> <td>→</td> <td>32</td> <td>subtypes</td> </tr> <tr> <td>O</td> <td>→</td> <td>11</td> <td></td> </tr> <tr> <td>C</td> <td>→</td> <td>5</td> <td></td> </tr> <tr> <td>SAT₁</td> <td>→</td> <td>7</td> <td></td> </tr> <tr> <td>SAT₂</td> <td>→</td> <td>3</td> <td></td> </tr> <tr> <td>SAT₃</td> <td>→</td> <td>4</td> <td></td> </tr> <tr> <td>ASial</td> <td>→</td> <td>3</td> <td></td> </tr> </table> <p>• antigenic Variations occur due to antigenic drift (point mutation) in Vp₁</p> <p>• No Cross reaction between these serotypes</p> <p>• In Egypt:</p> <ul style="list-style-type: none"> → In the past O₁ → Now O₁, A₂₂ and SAT₂ 	A	→	32	subtypes	O	→	11		C	→	5		SAT ₁	→	7		SAT ₂	→	3		SAT ₃	→	4		ASial	→	3		<p>• Specimens:</p> <ul style="list-style-type: none"> → epithelial cover of vesicles → Vesicular fluid → Ln, thyroid, heart <p>• Lab. diagnosis:</p> <p>① Rapid detection of viral Ag in clinical specimen (vesicular fluid or epith.) → cFT was used but now direct sandwich ELISA is used</p> <table border="0"> <tr> <td><u>+ve result</u></td> <td><u>-ve result</u></td> </tr> <tr> <td>FMDV is present in the specimen</td> <td>virus isolation to ↑ its titer → after this repeat ELISA</td> </tr> </table> <p>② Virus isolation in BHK-21:</p> <p>CPE → Rounding of the cell → pycnotic nucleus</p> <p>③ Virus identification:</p> <ul style="list-style-type: none"> • Serotype → determined by ELISA • subtype → determined by VNT <p>④ Serological test (ELISA) to detect 3 ABC or VIA antibodies</p> <p>→ to differentiate between vaccinated and infected animal (vaccinated A' not contain these NSP)</p> <p>⑤ Nucleotide sequencing of the Vp-1 gene of an isolate → used for comparison with other isolates of the same serotype to determine the origin of outbreak</p> <p>⑥ RT-pcr and Realtime RT-pcr</p>	<u>+ve result</u>	<u>-ve result</u>	FMDV is present in the specimen	virus isolation to ↑ its titer → after this repeat ELISA	<p>① Inactivated vaccine</p> <p>Tc inactivated vaccine</p> <p>→ was contained O₁ strain but now it contains serotypes O₁, A₂₂ and SAT₂ (Trivalent vaccine) in Egypt.</p> <p>② Subunit vaccine:</p> <p>The vaccine contain Vp₁ → prepared either by:</p> <ul style="list-style-type: none"> • DNA copy contain Vp₁ gene ligated to E. coli plasmid. • or peptide synthesizer
A	→	32	subtypes																																
O	→	11																																	
C	→	5																																	
SAT ₁	→	7																																	
SAT ₂	→	3																																	
SAT ₃	→	4																																	
ASial	→	3																																	
<u>+ve result</u>	<u>-ve result</u>																																		
FMDV is present in the specimen	virus isolation to ↑ its titer → after this repeat ELISA																																		

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	Serotype and antigenicity	Lab. diagnosis	Vaccines
④ Rabbit hemorrhagic disease (RHD) مرض النزف الدموي الفيروسي في الأرانب		<ul style="list-style-type: none">• Specimens:<ul style="list-style-type: none">→ Fresh rabbit tissues of Liver, Spleen, Lung and blood. (for virus isolation)→ Formalin fixed tissues (for IFT or Ip)→ all excretions• Lab. diagnosis:<ul style="list-style-type: none">① Virus isolation: Virus <u>not grow</u> on Tc so rabbits are used for propagation, isolation and titration of RHDV② Virus identification Viral Ag detected by If, Ip and ELISA③ EM (Immunoelectron microscope): used to detect the virus④ Ab identification:<ul style="list-style-type: none">• HI (RHDV Cause HA of <u>human type O RBCs</u>)• ELISA, Western blotting technique.⑤ RT-PCR	Inactivated homogenate of infected rabbit Liver mixed with adjuvant.
⑤ Bovine Virus diarrhea (BVD) مرض الأمهال الفيروسي في الأبقار	<ul style="list-style-type: none">• There are <u>2 different genotypes</u> acc. to difference of the 5' UTR of the viral genome → <u>BVD₁</u> and <u>BVD₂</u>• There are <u>2 different biotypes</u> acc. to growth characteristics of the virus in cell culture<ul style="list-style-type: none">→ cytopathic virus (CP)→ Noncytopathic (NCP)• There is close antigenic relationship between:<ul style="list-style-type: none">→ BVDV→ border disease virus→ Swine fever virus	<ul style="list-style-type: none">• Specimens:<ul style="list-style-type: none">→ Whole blood (buffy coat) - Serum (paired)→ Feces, Ln, intestine→ aborted Fetus• Lab. diagnosis:<ul style="list-style-type: none">① Virus isolation: in MDBK → <u>cytopathic BVDV</u> produce CP → damage to cell membrane → cell rounding - vacuole formation → grape-like clusters → ICIB② Virus identification:<ul style="list-style-type: none">CP biotype NT, ELISANCP biotype IF, Ip, Interference test③ Viral Ag detection → IF → Immunohistochemical st → Ag capture ELISA④ Multiplex PCR	<ul style="list-style-type: none">① Inactivated Tc Vaccine<ul style="list-style-type: none">↓pneumo 3 pneumo 4 pneumo 5BVDV BVDV BVDV₁IBRT IBRT BVDV₂PI3 PI3 IBRT BRSV PI3 BRSV② Live attenuated Tc Vaccine: Not used in pregnant A and in persistent infected A as it Lead to mucosal disease.③ Temperature sensitive mutant vaccine
④			

Infection of pregnant cow by BVDV:

♦ Infection of pregnant cow with NCP biotype of BVDV differ acc. to stage of embryo:

① Very early infection (< 80 days):

Embryonic death and resorption with infertility and repeat breeder in cows.

② Infection at 80 - 125 days:

♦ The virus affect the organogenesis and cause defects in eye (Retinal dysplasia) and CNS (Cerebellar hypoplasia and activation of Cerebrum) → Fetal death.

♦ Or Lead to Weak Calf Syndrome → The calf survive and become persistent infected (act as a carrier and shed the virus in all its secretions and excretions) → The calf not produce Abs against the virus (seronegative) (Immunotolerant).

③ Infection after 125 days:

The calf survive and shed the virus and produce Abs.

♦ ♦ Later (6 months to 2 years of age) → Cytopathic biotype arise from NCP BVDV as a result of recombination that include

- Insertion of host RNA.
- duplication of viral RNA sequence
- mutation in the NS 2-3 gene.

♦ Cytopathic mutant may result from recombination between NCP virus and superinfecting heterotypic cytopathic virus (as occur in vaccine associated outbreaks).

♦ The result is Mucosal disease.

الطيبون قناديل قليل
لكن نورهم يضيء الكون بأكمله
أكرمكم ربي بدعوه لا ترد
ورزق لا يعد
وباب الي الجنة لا يسد ويسر
الله اموركم لما يود.. آمين

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	Serotype and antigenicity	Lab. diagnosis	Vaccines
⑥ Avian Infectious bronchitis (IB) مرض التهاب الشعب الهوائية في الطيور	due to mutation of S-protein gene, there are several serotypes of IBV (7-8) but they are grouped into 2 types: • Connecticut • Massachusetts → There is cross reaction between serotypes	• Specimens: trachea, bronchi and Lungs • Lab. diagnosis: ① Virus isolation: • ECE via allantoic cavity → dwarfing and curling of embryos (ball-like) • Tracheal organ culture (TOC) → sloughing of cilia ② direct detection of virus in tissue section by IFT (rapid diagnostic test)	① Live attenuated Virus Vaccine (Massachusetts) ② Inactivated Virus Vaccine
⑦ Newcastle disease (ND) (paramyxovirus -1) مرض النيوكاسل أو الشوطة في الطيور	One Serotype antigenically	• Specimens: → Tracheal and cloacal swabbing → Lung, brain, spleen, liver and kidneys • Lab. diagnosis: ① Virus isolation (Cultivation) a - ECE via allantoic cavity: • death of embryo • hemorrhage on skin, wing and leg of embryo • allantoic fluid → + HA confirmed by HI b - TC: BHK 21 or chicken embryo fibroblast clear CPE → syncytia formation → inclusion bodies → HD c - Lab. A: IC in mice → nervous symptoms ② Immunological tests: ELISA, HI	① Live attenuated Vaccine: prepared from mesogenic strain → as Komarov, Mukteswar • Lentogenic strain → as F-strain, Hitchner B1, Lasota ② Inactivated Vaccine ③ Recombinant Vaccine for HN genes with fowl pox or other viruses
⑧ Rinderpest (cattle plague) الطاعون البقري	Only one serotype • Immunologically related to viruses that cause → Canine distemper → Measles → PPR • Close serologically with PPR	• Specimens: Conjunctival fluid, feces, citrated whole blood (buffy coat), intestine virus present in blood and secretions before symptoms appear. • Lab. diagnosis: ① Impression smear: Examination of stained impression smear prepared from epithelia of tonsils and other lymphoid tissues → syncytia formation ② Virus isolation: ICIB TC → syncytia formation + ICIB	① Inactivated Vaccine ② Live attenuated Vaccine → Caprinized → 250 passage → Lapinized → 100 → avianized → 19-25 → TC vaccine → 70 In Egypt: Live attenuated TC vaccine contain Kabeteo strain. ③ Recombinant vaccinia and capripox virus vaccine

	serotype and antigenicity	Lab. diagnosis	Vaccine
<p>⑨ avian Influenza (Fowl Plague) (Bird Flu)</p> <p>الفلونزا الطيور</p>	<p>Many Serotypes acc. to surface antigens (HA and NA)</p> <p>• HA → 18</p> <p>• NA → 11</p> <p>→ Most Common Subtypes → H5N1, H5N2, H7N5</p> <p>• antigenic Variation of avian influenza virus → antigenic drift → antigenic shift</p> <p>• No Cross reaction between subtypes.</p>	<p>• Specimens:</p> <p>1. Live birds → Nasal, tracheal and cloacal swabs, sinus exudate, blood and paired sera</p> <p>2. dead birds → tracheal and Lung tissue, pooled tissue of organs</p> <p>• Lab. diagnosis:</p> <p>① Virus isolation:</p> <p>• ECE via allantoic cavity → testing the allantoic fluid by HA test → then HI test.</p> <p>• Tc: MDCK</p> <p>→ cpe → ICIB and INIB</p> <p>→ giant cells and plaques</p> <p>→ testing of Tc fluid by HA and HI</p> <p>→ testing of infected cells by HD</p> <p>② Virus identification:</p> <p>using known antisera to detect internal NP antigen (typing of isolate) → by serological tests as IFT.</p> <p>③ Subtyping:</p> <p>using MAbs against HA(18) and NA(11) antigens using HI and NI tests</p> <p>④ detection of Abs → by HI test</p> <p>⑤ pathogenicity test (Live bird challenge test)</p> <p>IC in 1 day old chickens → 75 - 100% mortality</p> <p>⑥ DIVA (differentiating infected from vaccinated animals):</p> <p>depend on presence of NS1 protein in infected bird not in vaccinated one → detected by using anti-NS1 protein using IFT.</p> <p>⑦ genome sequence detection and analysis:</p> <p>RT-PCR used to amplify HA gene then sequencing</p>	<p>① Inactivated Virus Vaccine</p> <p>② Live attenuated Vaccine (FLUMIST)</p> <p>③ Recombinant HA protein vaccine or Recombinant Fowl pox virus vector vaccine</p>

	serotype and antigenicity	Lab. diagnosis	Vaccine
<p>⑩ Rift Valley Fever (RVF) (Enzootic hepatitis)</p> <p>حمى الوادى المتصدع في الأغنام</p>	<p>only one serotype</p> <p>• Serologically related to other phlebo-viruses.</p>	<p>• <u>Specimens:</u> blood, Liver, brain, freshly aborted fetus and placenta</p> <p>• <u>Lab. diagnosis:</u></p> <p>① <u>Virus isolation:</u></p> <p>• <u>Lab. A'</u> → IC inoculation of blood in baby mice or adult mice → fatal hepatitis</p> <p>• <u>Tc (vero cells - BHK 21)</u> → CP E (plaques and inclusion bodies)</p> <p>② <u>Virus identification:</u> SNT</p> <p>③ <u>Histopathological examination of Liver</u> → characteristic lesion and inclusion bodies</p> <p>④ <u>Ag detection in impression smears of Liver, spleen and brain</u> → by IFT</p>	<p>① <u>Live attenuated Vaccine:</u> may cause abortion and birth defects in pregnant A'</p> <p>② <u>Inactivated Vaccine:</u> <u>In Egypt:</u> Inactivated Tc Vaccine contain the local strain (Zagazig strain)</p>
<p>⑪ Bovine Ephemeral Fever (BEF) (3-day sickness)</p> <p>حمى الثلاثة أيام في الأبقار</p>		<p>• <u>Specimens:</u> Citrated blood (buffy coat) during fever, Lung, Ln</p> <p>• <u>Lab. diagnosis:</u></p> <p>① <u>Virus isolation:</u> difficult</p> <p>• <u>Lab. A'</u> → I/C inoculation of buffy coat in suckling mouse brain.</p> <p>• <u>Tc (vero cells, BHK-21)</u> → CP E → cell rounding, cell detachment, plaque formation</p> <p>② <u>Virus identification</u> → by IFT, ELISA</p> <p>③ <u>Serology</u> → seroconversion</p> <p>④ <u>Hematology:</u></p> <p>• <u>during febrile phase</u> → ↑ Leukocytes (Lymphocytes) ↑ Fibrinogen ↓ serum Ca Level</p> <p>• return to normal on recovery</p>	<p>① <u>Live attenuated virus vaccine (Australia)</u></p> <p>② <u>Inactivated Vaccine</u></p>

	Serotype and antigenicity	Lab. diagnosis	Vaccine																
⑫ Rabies مرض السعار	• There is only <u>one</u> serotype of Rabies virus.	• <u>Specimens</u> : brain (hippocampus, cerebellum and cerebral cortex) placed in 50% glycerol saline.	① <u>Modified Live Virus Vaccine</u> :																
	• <u>Types of Rabies Virus</u> :	• <u>Lab. diagnosis</u> :	• Canine Cell Line origin (HEp, Flury strain)																
	① <u>street virus</u> → strains of rabies virus occurring in animal under natural conditions	① <u>Histopathological examination of impression smear or histological section of brain tissue: stained by Seller's stain</u> → for detection of <u>Negri bodies</u> in cytoplasm	• porcine TC origin.																
	② <u>Fixed virus</u> → strains of rabies virus adapted in Lab. animals.																		
	<table><tr><th>street strain</th><th>fixed strain</th></tr><tr><td>Isolated from diseased animal</td><td>Lab. adapted strains</td></tr><tr><td>Long incubation period</td><td>short incubation period.</td></tr><tr><td>produce ICIB (Negri bodies)</td><td>Not produce, negri bodies.</td></tr><tr><td>have tropism to salivary gland, eye, brain and skin</td><td>have tropism only to brain tissue</td></tr><tr><td>highly pathogenic for animal and man</td><td>Less pathogenic</td></tr><tr><td>Not used in vaccine preparation</td><td>used in vaccine preparation</td></tr><tr><td>presence of Arginine and Lysin residue at position 333 of G-protein.</td><td>Not present</td></tr></table>	street strain	fixed strain	Isolated from diseased animal	Lab. adapted strains	Long incubation period	short incubation period.	produce ICIB (Negri bodies)	Not produce, negri bodies.	have tropism to salivary gland, eye, brain and skin	have tropism only to brain tissue	highly pathogenic for animal and man	Less pathogenic	Not used in vaccine preparation	used in vaccine preparation	presence of Arginine and Lysin residue at position 333 of G-protein.	Not present	② <u>Immunofluorescence (IFT)</u> : used for rapid detection of viral Ag in brain (infected dog or inoculated mice) and TC.	② <u>Inactivated virus TC Vaccine</u> BHK-21
	street strain	fixed strain																	
	Isolated from diseased animal	Lab. adapted strains																	
	Long incubation period	short incubation period.																	
	produce ICIB (Negri bodies)	Not produce, negri bodies.																	
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presence of Arginine and Lysin residue at position 333 of G-protein.	Not present																		
	③ <u>Animal inoculation</u> : IC inoculation of mice with brain suspension → muscular tremors, paralysis and death • Histopathological examination of mouse brain → <u>Negri bodies</u> • Confirmed by <u>SNT</u> in mice or <u>FAT</u>	<u>In Egypt</u> : 1- <u>avianized rabies vaccine</u> : Live attenuated vaccine contain Flury strain (LEP)																	
	④ <u>RTCIT (Rabies TC infection test)</u> : virus isolation in neuroblastoma or BHK cells → detection of rabies virus by <u>FAT</u> .	2- <u>Inactivated TC Vaccine</u> : propagated in BHK-21																	
	⑤ <u>Serology</u> → <u>FAT</u>																		
	⑥ <u>RT-PCR</u>																		

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	Serotype and antigenicity	Lab. diagnosis	Vaccine				
⑬ Blue Tongue (BT) (ovine Catarrhal Fever, Sore mouth) مرض اللسان الأزرق في الأغنام	<ul style="list-style-type: none">There are <u>25-26</u> different serotypesIn Egypt: Serotypes 1, 4, 12 and 16Each type produce solid homologous immunity but give a variable degree of protection to heterologous challenged type.	<ul style="list-style-type: none"><u>Specimens:</u><ul style="list-style-type: none">citrated blood collected at febrile stage (buffy coat) → BTV affect endothelial and hemopoietic cellsspleen and Ln.<u>Lab. diagnosis:</u><ul style="list-style-type: none"><u>① Virus isolation:</u><ul style="list-style-type: none">ECE (YS, CAM or IV route) → death of embryo with multiple hemorrhage → Infected CAM used as a source of virus Ag in VNT, CFT and ELISA test.Lab. A' → in the brain of unweaned mice and hamsters → encephalitis and deathTc (BHK 21, MS) → ICIB<u>② Virus identification</u> → CFT, FAT, SNT<u>③ antibody identification</u> → CFT<u>④ biological test</u>	<ul style="list-style-type: none"><u>① Live attenuated Virus Vaccine</u> <u>disadv.:</u><ul style="list-style-type: none">abortion and fetal deathuse of multivalent vaccine can lead to emergence of genetic reassortants<u>In Egypt:</u> Tc attenuated vaccine prepared in MS cells<u>② Inactivated Vaccine:</u> Safe				
⑭ Infectious Bursal disease (IBD) (Gumboro disease) مرض الجربورو أو الكيور	<ul style="list-style-type: none">There are <u>2 serotypes</u> <table><thead><tr><th>ST₁</th><th>ST₂</th></tr></thead><tbody><tr><td>→ pathogenic → mainly affect chicken</td><td>→ avirulent → affect chicken, ducks and turkeys.</td></tr></tbody></table> <p>ST₁ ↓ Mutation in VP₂ virulent ST₁ (VST₁) ↓ Mutation very virulent ST₁ (VVST₁)</p>	ST ₁	ST ₂	→ pathogenic → mainly affect chicken	→ avirulent → affect chicken, ducks and turkeys.	<ul style="list-style-type: none"><u>Specimens:</u> bursa of Fabricius, Liver, spleen, Kidney and Lung<u>Lab. diagnosis:</u><ul style="list-style-type: none"><u>① Virus isolation:</u><ul style="list-style-type: none">ECE (via CAM): death of embryo with S/C edema, hemorrhages, stunted growth, mottled hemorrhages in LiverTc (chicken embryo kidney cell culture): CPE → cell necrosis and plaque formation<u>② Virus identification:</u><ul style="list-style-type: none">FAT → detect viral Ag in smears or frozen sections of the bursa.ELISA, VNT and AGPT → used for detection of viral Ag in macerated bursal tissue<u>③ Ab identification:</u> → SNT, ELISA<u>④ Molecular techniques</u> → RT-PCR	<ul style="list-style-type: none"><u>① Live attenuated Virus Vaccine</u> prepared in vero cells<u>② Inactivated Vaccine</u><u>③ ReCombinant Vaccine:</u> recombinant fowl pox virus vector vaccine (expressing VP₂ gene)
ST ₁	ST ₂						
→ pathogenic → mainly affect chicken	→ avirulent → affect chicken, ducks and turkeys.						

	serotype and antigenicity	Lab. diagnosis	Vaccine
15 Sheep pox جدرى الأغنام	<u>only one serotype</u> • There is cross reaction between sheep pox virus, goat pox virus and LSDV (members of genus Capripoxvirus)	• <u>Specimens</u> → blood (during viremia) → skin pox lesions → lung - serum • <u>Lab. diagnosis:</u> ① detection of ICIB in histological section stained by H&E ② Rapid detection of virus by EM or FAT ③ <u>Virus isolation:</u> • ECE via CAM → pock lesions • TC → clear CpE (ICIB) ④ <u>Ag capture ELISA</u> → for viral Ag detection. ⑤ <u>Ab identification:</u> by VNT, Indirect FAT, Indirect ELISA ⑥ PCR	<u>Live attenuated Vaccines:</u> In Egypt: prepared from Roumanian sheep pox virus → injected I/d in hairless area (under tail) ② <u>Inactivated virus Vaccine:</u> Inactivated by formalin
16 Lumpy skin disease (LSD) مرض الجلد الفقدي في الأبقار	<u>only one serotype</u> • There is cross reaction between sheep pox virus, goat pox virus and LSDV. • Sheep pox (Kenyan strain) is identical to Neethling strain of LSDV.	• <u>Specimens</u> → blood → skin nodules → lung, Ln, spleen • <u>Lab. diagnosis:</u> as sheep pox	① <u>Sheep pox virulent Vaccine:</u> propagated in TC (Heterologous Vaccine) ② <u>attenuated Neethling virus strain:</u> 60 passages in Lamb kidney TC followed by 20 passages in chicken embryo

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	Serotype and antigenicity	Lab. diagnosis	Vacc.
17) Infectious Laryngo-Tracheitis (ILT) (gallid herpesvirus - 1) مرض التهاب الحنجرة والقصبة الهوائية المعدى في الطيور	only one serotype	<ul style="list-style-type: none"> specimens: \rightarrow Tracheal exudate \rightarrow Lung suspension Lab. diagnosis: <ol style="list-style-type: none"> detection of INIB in histological section (tracheal tissue) Rapid detection of virus in tracheal exudate by EM or FAT. Virus isolation: <ul style="list-style-type: none"> ECE via CAM \rightarrow pock Lesion Tc \rightarrow INIB Viral Ag detection in tracheal sample by FAT, ELISA, AGPT. Ab identification by VNT, ELISA PCR 	<ol style="list-style-type: none"> Live Virulent Virus (Low Virulence) used by cloacal vaccination Live attenuated Vaccine given by infra-orbital sinus or intranasal or eyedrops route
18) Marek's disease (MD) (gallid herpesvirus - 2) مرض هارييه في الطيور	<ul style="list-style-type: none"> There are 3 serotypes: <ol style="list-style-type: none"> S₁ (GHV2): <ul style="list-style-type: none"> Mostly cause Marek's disease pathogenic, oncogenic affect chicken S₂ (GHV3): <ul style="list-style-type: none"> Non-pathogenic, Non oncogenic affect chicken. S₃ (MHV1): <ul style="list-style-type: none"> avirulent, non oncogenic affect turkeys ALL strains are antigenically similar. 3 Viral Ag (A, B, C): <ul style="list-style-type: none"> A (cell free Ag) B, C (cell associated Ag integrated in cell). one non viral Ag (MATSA "Marek associated tumor Surface Ag") Formed on surface of infected cell. 	<ul style="list-style-type: none"> specimens \rightarrow heparinized blood (buffy coat) \rightarrow spleen, tumor tissue \rightarrow feather follicle epith. Lab. diagnosis: <ol style="list-style-type: none"> Rapid detection of viral Ag in feather follicle by direct FAT. Virus isolation: <ul style="list-style-type: none"> ECE via CAM \rightarrow pock Lesion Tc \rightarrow INIB detection of MATSA on cell surface of tumor tissue \rightarrow by using known Abs \rightarrow by IFT. Ab identification: by VNT, Indirect FAT, ELISA PCR 	<ol style="list-style-type: none"> Herpes virus of turkey (HVT) (Heterologous vaccine) Live attenuated Tc Vaccine: Vaccinate embryo at 18th day old (In-ovo vaccination) Recombinant Vaccine

Q Enumerate Viral diseases causing respiratory manifestations in poultry and how can you differentiate between them Laboratory.

	ND	AI	ILT	Fowl pox	IB
	CAM inoculation	Effect on embryo	HA on allantoic fluid		
ND	No gross Lesion	Lethal 48-72 hrs	+ve HA		
AI	No gross Lesion	Lethal	+ve HA		
ILT	pock Lesion	No gross Lesion	-ve HA		
Fowl pox	pock Lesion	No gross Lesion	-ve HA		
IB	No gross Lesion	Curling and dwarfing	-ve HA		

• differentiation between ND and AI → by HI (Haemagglutination inhibition test)

• differentiation between ILT and Fowl pox

ILT	Fowl pox
Intranuclear inclusion bodies	Intracytoplasmic inclusion bodies

Viral diseases

Cattle diseases:

- ① FMD → vesicle in mouth and foot
- ② BVD → diarrhea, abortion
→ Immunosuppression
- ③ Rinderpest → Four D's = diarrhea, dehydration, depression, death
- ④ Rift Valley fever
- ⑤ Bovine ephemeral fever → Lameness, stiffness
- ⑥ Rabies
- ⑦ Lumpy skin disease → skin nodules
→ sit fast
→ abortion
- ⑧ BSE (mad cow disease) → nervous signs

Sheep diseases:

- ① FMD
- ② Rift Valley fever → death of young
→ abortion
- ③ blue tongue → purplish blue tongue
→ abortion
- ④ Rabies
- ⑤ Sheep pox → skin pox lesions
→ death of young
- ⑥ Scrapie → Nervous signs

Rabbit disease:

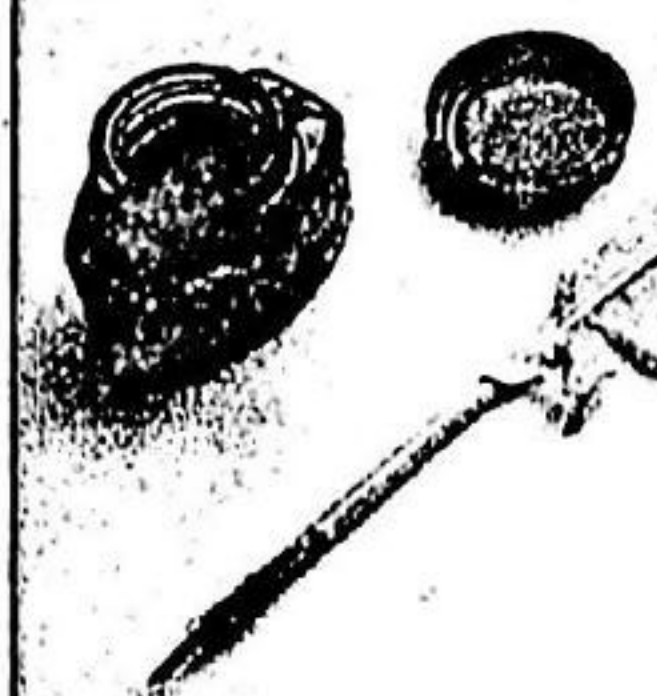
Rabbit hemorrhagic disease (RHD) → Sudden death of rabbit (↑ 2 months) and unique intravascular Coagulopathy

dog disease:

Rabies → great excitement, paralysis, hydrophobia

poultry diseases:

- ① duck virus hepatitis → Fall on their sides
→ Kick spasmodically
- ② avian encephalomyelitis → ataxia and paralysis
- ③ Infectious bronchitis (IB):
resp. signs, nephritis, ↓ egg production
- ④ Newcastle disease (ND):
resp. signs, nervous and enteric signs
- ⑤ avian influenza (AI):
↑ mortality, resp. signs, edema of head,
↓ egg production.
- ⑥ Infectious bursal disease (IBD) (gumboro disease) → diarrhea with soiled vent
→ bursa enlarged then atrophied
- ⑦ Fowl pox
- ⑧ Infectious Laryngotracheitis (ILT):
resp. signs, expectoration of caseous bloody exudate.
- ⑨ Marek's disease:
paralysis, tumors, grey eye and irregular, eccentric pupil



تحيه شكر

تتناثر الكلمات خيراً وحباً..
على صفائح الأوراق..
لك من علمي..
ومن أزال غيمة جهل مررت بها..
برياح العلم الطيبة..
وللك من أعاد رسم ملاحي..
وتصحيح عثراتي..
أبعث تحية شكر واحترام.

زهر
ZHR
SHB
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